

REPORT
ON THE
LINE OF NAVIGATION
FROM
HEXHAM TO HAYDON-BRIDGE,
PROPOSED AS A
CONTINUATION OF THE STELLA AND HEXHAM CANAL;
WITH COMPARATIVE OBSERVATIONS ON THE
PROPOSED CANALS
On each Side of the River Tyne:
AND
A REPORT
ON THE
LINE FROM NEWCASTLE TO HAYDON-
BRIDGE,
On the North Side of that River;
TOGETHER WITH
FULL ESTIMATES OF THE EXPENCE OF EXECUTION.

BY JOHN SUTCLIFFE, ENGINEER.

NEWCASTLE:

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[PRICE ONE SHILLING.]



TO THE
COMMITTEE OF THE INTENDED CANAL
ON THE
SOUTH SIDE OF THE RIVER TYNE.

GENTLEMEN,

HAVING, in pursuance of your directions, made a survey of the country between Hexham and Haydon-Bridge, with a view to the extension of the Stella and Hexham Canal to Haydon-Bridge, and from thence to the West Sea, whenever circumstances shall render it expedient, and also of the projected line from Newcastle to Haydon Bridge on the north side of the river Tyne, I proceed to communicate the result of such surveys, and my observations thereon, together with an estimate of the expence of executing each of these lines.

The line I propose as the most eligible for a canal from Hexham to Haydon-Bridge will commence at the intended basin at Hexham, from which I propose to ascend by 64 feet of lockage to the summit level in a common-garden at the
A head

head of the Broad-Gate, and thence proceeding westward, will cross the turnpike-road between the high end of the town and a cottage belonging to Mr Michael Bell; thence crossing Cockshaw Burn, and passing through the upper part of Shaf-toe Leazes, it will proceed past the south end of a cottage belonging to Bacon William Wastell, Esq. and continuing westward, will pass along the low ground between Highwood farm-house and the Woodland north thereof; thence proceeding on the same level, and crossing Coastley Burn, it will pass about 10 yards north of the cottage at Windyhurst, and thence through Wharnley estate to the rock opposite Allerwash corn mill, from which place to near the western boundary of Wood-shields estate it will pass along the top of the rock, with the average depth of 16 feet of extra digging; from thence it will pass in favourable ground through the Bush and Woodhall estates, and passing north of Woodhall mill and the farm-house, it will enter Broad-stone close, belonging to Francis Tweddell, Esq. adjoining the south side of the street at Haydon-Bridge, upon a level about 25 feet higher than the proposed line on the north side of the River. Whenever it shall be found expedient to extend this line westward from Haydon-Bridge, the same level will enable you to do so, without encountering any particular difficulty or expence.

This

This line will pass on the south side of the town of Hexham, and from thence to and through the village of Haydon-Bridge, without being anyways offensive or injurious to any house or cottage whatever: And it is not a little extraordinary, yet a fact no one can deny, that a canal may be made on the south of the Tyne from Newcastle to Haydon-Bridge, about 29 miles in length, without doing the least injury to any one gentleman's house or pleasure grounds, which is the first instance of the kind I ever met with.

It is very singular that it should have been so roundly asserted by some professional engineers, and supported by others, that a good line of canal could not be found on the south of the Tyne between Hexham and Haydon-Bridge; but whoever will give himself the trouble carefully to examine the country between Stella and Haydon-Bridge on the south of the Tyne, will be constrained to acknowledge that that part of the line which is between Hexham and Haydon-Bridge, and has been represented as impracticable, is by much the easiest part of it, because there is less fall per mile, it is better supplied with water, as there is no necessity for reservoirs, and it may be executed for less money per mile than the line from Stella to Hexham. If ever the tonnage should increase in the upper part of the line so as to exceed the supply

ply of the brooks, rivulets, and springs in the summer months, which I think is never likely to be the case, a reservoir may be made in **Coastley Burn** that will contain at least 8,000 locks full of water, but may be extended to much more, which will not cover 10 acres of cultivated ground, and the head or bank for which may be made for 650l. If the line between Hexham and Haydon Bridge should be executed, there will not be a necessity for both the proposed reservoirs on the lower part of the line, and that in Riding Burn may be dispensed with, which would be a saving of 5,000l. certainly a strong temptation to execute the line from Hexham to Haydon-Bridge.

The line on the south side of the river from Hexham to Haydon-Bridge is about a mile shorter than that proposed on the north side, and may be executed for a great deal less money, as appears by a comparison of the estimates I have made; and if there should be a canal made from Stella to Newcastle, the whole length of the canal on the south side will be about two miles less than that proposed on the north side to the proposed basin at West Gate, from whence there will be more than a mile of *land-carriage to the quays*, or the low part of the town. This great difference in the length of the two lines is of no small consequence to the public, but more especially if it be considered that all the
goods

goods which may pass on the north line eastward, and are intended for the quays at Newcastle, as well as all goods going from the quays westward, will be subject to more than a mile of *land-carriage* through the town.

In my Report on the south line I stated the loss in consequence of this carriage to be 2s. per ton; but consulting with various persons conversant in the expence of carrying goods in the town, I find that sum is a great deal too little, and that 2s. 6d. ought to be the mean price for goods going from the quays to the basin; and I also found that the 1s. per ton I allowed for carrying goods from the canal to Hexham, or from there to the canal, is also too little; but I shall not alter either of these statements. I have before observed that the south line will be about two miles shorter than the north line. The freight and lock dues of two miles will be at least 6d. per ton, which added to the 2s. before-mentioned, will make 2s. 6d. per ton against the north line.—The proposed basin for the north line at Haydon-Bridge is at so great a distance from the south part of the village, that no goods can go from the south side of the river to that basin without an expence of at least 6d. per ton more than if put on board at the proposed basin on the south side, which added to the 2s. 6d. will make 3s. per ton against the north line: And it
is

is clear to me that no lead, grain, or timber, that is got or grown on the south side of the Tyne, any where near or west of Haydon-Bridge, can be carried on the north line, and afterwards conveyed to the quays at Newcastle, (where I understand nearly all the lead is delivered) but it will cost 3s. per ton more than if carried on the south canal; and were I to calculate upon this line, ending at Stella where it is now proposed, and take into the account the saving of lock dues from Stella to Newcastle, which would be about 1cd. per ton more, the whole difference would be 3s. 1od. per ton against the north line. But I do not wish to state any thing high, as without doing so there is enough in favour of the south line to convince any unprejudiced person that the north line ought never to be executed, inasmuch as there is another proposed that is on all accounts better calculated to serve the general good of the country, and in particular the Greenwich Hospital estates and all the lead proprietors.

I am not so fortunate as to have the honour of being acquainted with the gentlemen who manage the Greenwich Hospital estates, and I am ready to admit they must be allowed to know the general interest of those estates much better than I can be supposed to do; but notwithstanding this, I will be obliged to them, or any other person, if
they

they will have the goodness to shew me or the public that I am mistaken in the above calculations in which those estates are so much concerned ; and if they cannot do so, I hope they will be convinced they have erred in the choice of their line.

Much has been said of the advantages the north line will have over the south in the use of pleasure or packet boats, and I believe the subscribers to it have been as much mistaken in the supposed revenue to arise therefrom as in any one thing.—By the engineer's calculations, I see he makes the revenue to arise from those boats a principal part of the whole revenue of the canal ; and I am ready to admit that if he cannot raise a large revenue from such boats, it will be extremely difficult for him or any other person to shew that any considerable revenue can be raised at all ; but how the engineer has got it into his head that pleasure or packet boats, which are to pass through a country uncommonly thin of inhabitants, and nearly without trade, will be so exceedingly lucrative to the subscribers, is quite beyond my comprehension, and he must surely have calculated that the principal part of the inhabitants will travel daily upon it for nothing but pleasure, as it cannot be for the purpose of trade for the reason I have given.

When I was at Haydon-Bridge upon the survey,
I found

I found the people there greatly anticipated the pleasure and conveniency of travelling from thence to Hexham market in those boats ; but they seemed entirely to forget that, besides travelling near nine miles by water, they would have to walk about one mile from the canal to the town, making in all, going and returning, about 20 miles, whereas they now can travel upon a good public turnpike road, by which the distance is only 6 miles each way.—If a canal is made from Newcastle to Haydon-Bridge on the south of the Tyne, packet boats may be established upon it to answer the same purpose as those proposed on the north line, and the passengers need never be incommoded with passing through the locks. The passengers might get in at Newcastle, and when they arrived at the foot of the first lock at Stanley Burn, might get out and walk up to the upper pool, where they would find a boat ready to receive them, and that boat which conveyed them up to the foot of the locks would return back to Newcastle with the passengers that were coming down ; and when the boat on the upper pool got to Hexham, the passengers would meet another boat on the upper pool ready to receive them ; and by having two extra boats, no more men or horses would be required. By adopting this plan, all the time that would be wasted in a boat passing the locks, as well as the
water

water required to carry it through them, would be saved, except about 10 minutes for the passengers to walk up to the upper pool. This is a plan that is used on many canals, and is found to answer extremely well.—It is thus clear, that if a canal was executed on the south of the Tyne from Newcastle to Haydon-Bridge, packet boats might pass on it as well as on the north line, and with this advantage, that they would pass much quicker, and require less power to tow them along, for three reasons: 1st, The south line being about two miles shorter, a boat would pass sooner upon it than on the north line, as the time required for the passengers to walk from one pool to another would not be equal to the time a boat would be in travelling two miles.—2dly, Boats will travel with more speed upon the south line, in consequence of its being so much straighter than the north line, which is so extremely crooked, that the packet boats cannot move upon it with the velocity required to make them of public utility.—3dly, As the north canal will receive its principal supply of water at Haydon-Bridge, the packet boats which are calculated to sail swiftly would feel the distressing effects of navigating against the current, and the great resistance a boat would have to overcome would be equal to the square of the velocity with which it moved. But the south line is not

subject to this great imperfection, as a supply of water may be got almost upon any part of it, so as not to occasion any current.

If my advice has any weight with the subscribers to either the south or north line, I would recommend them never to expect any permanent revenue from pleasure or packet boats, nor should it ever be considered as any thing more than an accidental one; for discouraging indeed must be the prospect of the subscribers to any line of canal where a principal part of the revenue is to arise from packet boats, and more especially when that line of canal is carried through a country almost destitute of trade and very thin of inhabitants; and this is the case with the north line, as I have before observed.

Another great advantage the south line will have over that of the north is, that when the lower end of it is executed, either from Newcastle to Stella, or from Stella to Stanley Burn, a large revenue will immediately succeed; but as the north line must receive its principal supply of water from Haydon-Bridge, the whole of it must be executed before any revenue can be calculated upon with certainty, and the time required to execute it may be taken at from four to five years at the least.—If two years loss of interest on the whole principal be calculated, and less ought not to be reckoned, it

it will amount to a large sum, with which the cash account ought to be charged; and for obtaining the act, and carrying it into execution, (which includes the salaries for solicitors, clerks, engineers, committee meetings, and other incidental expences) 6 per cent. more may be required; but if a spirited opposition takes place, 10 per cent. may be found insufficient for these expences.—The engineer, I understand, proposes to pay the subscribers 6 per cent. interest during the time the works are executing: If he can do so, I am strongly inclined to think they will be twice as well paid during that period as they ever will be afterwards; and if he can make good this proposal, I think he is an able financier indeed; but how, or by what means he will perform it, I confess is inconceivable by me; and as the public are deeply interested in the discovery of a dead capital, sunk during the execution of any canal, being made to pay 6 per cent. interest to the subscribers, and as nothing will tend so much to the promotion of canals, I hope he will have the goodness to unfold this mystery.

Perhaps it may be said, there will not be all that loss of interest I have supposed during the time the works are executing, because a supply of water may be got from the proposed reservoirs in the summer months; but this I cannot admit; for

there is neither extent of ground for large drainage, nor a sufficient quantity of water in the brooks in which they are proposed to be placed, nor a sufficient space to contain a large quantity where they are intended to be made, to justify the making of them. The ground where the first reservoir is proposed to be placed is so very level, that a large quantity of it must be covered to acquire even a small depth of water; and the head for it will be of considerable length, and the breadth at the top must be great on account of the public road, which must be diverted along the top of it, because the reservoir will cover the present road, which will increase the expence of making the head or bank. The place proposed for the second reservoir is altogether improper, because of the expence that will attend making a head for so small a pond, which cannot admit of any considerable depth of water on account of the corn mill, and the flatness of the ground will cause a large quantity of it to be flooded to very little purpose; for which, and various other reasons, I think it ought not to be executed. The situation of the third reservoir is equally improper, on account of the want of water to supply it, and sufficient room to contain a moderate quantity; besides which it will lay the public road under water, and I think it is more than probable it will back-flood the cottages.

tages. There must be three heads or banks for these paltry reservoirs, which will make the execution very expensive, and when made, they will be fitter for duck ponds than auxiliaries for a canal.—My opinion is, that if those reservoirs were made, they would not supply themselves in the summer months with leakage, soakage, and evaporation; and that any money laid out in making them is wasted to no purpose, except deluging his Grace the Duke of Northumberland's collieries; for if they are made, I think this will be the inevitable consequence, unless the bottoms of them are covered with a lining puddle; and if his Grace is properly informed of the great danger to which his coal-mines will be exposed, I am inclined to believe he will never permit those reservoirs to be made.—Had I not seen and carefully examined the situation and the plan for them, I could not have conceived that any engineer would have been so imprudent as to have proposed those reservoirs.—The reservoir proposed in Whittle Dean will be of very little service to the canal, the place being so much contracted where it is proposed to be made, and the depth of water will be rather shallow; for was it to be made of any considerable depth, the bank or head would require to be extended to a prodigious length.—The smallness of that reservoir, and the great distance it will be
from

from the line, (which will make the expence heavy to convey so small a quantity of water to the canal) in my opinion, renders it very ineligible, tho' the want of room is more to be complained of than of water, for it does appear that in flood time a moderate quantity might be collected; but the situation where the reservoir is proposed will not admit of room to contain it.—I have carefully walked over and examined all the country on the north side of the river between Newcastle and Haydon-Bridge where there are any brooks or rivulets, and I freely confess I cannot find any situation for a reservoir that will justify the expence of making it, or from which water could be drawn to supply the north canal on its present level; but if it had been upon a level from 60 to 80 feet lower, two reservoirs might have been made, and supplied with a moderate quantity of surplus water.—To this great disadvantage, however, the south canal is not subject, as there are a great number of powerful brooks from which any quantity of flood or surplus water may be taken, and there are also extensive vallies where capacious reservoirs may be made, without the possibility of injuring any coal-mine; and between Hexham and Haydon-Bridge there are several considerable brooks, the whole of which may be taken for the supply of the canal without injuring any mill property.

The

The engineer for the north line describes, with a great deal of fine flowery language, the many great and singular advantages which would attend that line, but is entirely silent respecting the great utility of the reservoirs he has proposed; nor does he say one word about the quantity of land they would cover, the depth of water they would contain, or how long they would supply a given quantity of tonnage; and what is still more extraordinary, the expence of making them seems to have escaped both his observation and that of Mr Jessop, for no notice whatever is taken of them in their estimate for the north line.—What unpardonable negligence and inattention is this? First, to omit making any allowance in their estimate for supplying the south line with water; and secondly, to overlook the expence of making four reservoirs on the north side!—Perhaps these gentlemen or some of their friends will make an apology for them by saying, that at the time Mr Jessop and Mr Chapman made their survey of the north line, there was no intention of making reservoirs; but this is a very poor excuse, as it is now admitted by Mr Chapman that they are necessary; and to say that at the time the survey was made they were not thought of, is indirectly admitting that their estimate was a fallacious one; for it must necessarily be admitted that it was so, or that Mr Chapman.

man is about to throw away large sums of money in making reservoirs that never will be wanted.

At the conclusion of my former Report I promised to take notice of the great difference between the estimate made by me and that by Messrs Jessop and Chapman. The public will probably be desirous to have this great difference explained, and more especially as the estimate these gentlemen have published is about 20,000 l. less than mine, altho' they have an expensive tunnel and much deep digging which the line I propose is not subject to, and their line is also rather longer.—As it is probable that some persons who may read my report and estimate may not have an opportunity of reading Mr Chapman's report and the estimate made by him and Mr Jessop, it may not be amiss to introduce here a copy of that estimate.

*“ ABSTRACT of the Estimate of a Canal on the South
“ of the Tyne from Stella to Hexham, by Mr Jessop and
“ Mr Chapman.*

“ Length of the canal to Hexham $17\frac{1}{8}$ miles.

“ Ditto of the river from Stella to Newcastle $5\frac{1}{2}$ miles.

“ Rise from low water at Stella 107 feet.

“ EARTH WORK,

“ (Inclusive of walling off the river at the Hag.)

<i>“ Cutting in the steep bank at Ryton Haughs</i>	<i>£.</i>	<i>s.</i>	<i>d.</i>
	1640	0	0
		<i>“ Car-</i>	

" Carrying the canal in front * of the Hag, at a	£.
" sufficient elevation above the river, - - -	4500
" Cutting in face of Eltringham Scar † - - -	3340
" Tunnel through the deep part of	£.
" Farnley Scar - - -	4400
" Deep cutting east of the tunnel	719
" Cutting in face of the Scar west of the	
" tunnel - - -	2426
	7545
" Remainder of the earth work, including the	
" embankments and cutting not specified - - -	12228
	£. 19253
" Culverts over the different brooks, including an	
" aqueduct over the Devil's Water, - - -	1889
" Ten locks - - - - -	7000
" Basin at Hexham - - - - -	300
" Bridges, stop-gates, warehouses, lock-houses,	
" receivers, dischargers, &c. &c. - - -	8250
" Fences, hauling-path, back-drains, &c. - - -	2248
" Lining the canal in leaky soil - - - - -	3100
" 134 acres of land - - - - -	8040
" Contingencies at 15 per cent. - - - - -	9009
	£. 69081
* If cut thro' the Hag, the expence will be 117940 yards, at	
" 8d. per yard, - - - - -	3931
" 610 yards of tunnelling, at 20l. per yard, - - -	12200
	£. 16131

" † The canal may be carried at less expence by walling off the river in front of these scars."

I will now give a statement, shewing the difference in the various sums allowed for sundry work.

	£.	ought	£.
Remainder of the earth work, including embankments and cutting not specified,	12228	to be	16428
Culverts over different brooks, including an aqueduct over the Devil's Water,	1889	ditto	2699
Ten locks, 107 feet rise, - -	7000	ditto	11000
Lining the canal in leaky soil -	3100	ditto	3620
134 acres of land (<i>this quantity not suffi-</i> <i>cient</i>) - - - -	8040	ditto	10360
Expence of procuring water entirely o- mitted - - - -	—	ditto	8384
Deficiency in Messrs Jessop and Chap- man's estimate - - -	20234		
	<u>£. 52491</u>		<u>£. 52491</u>
The amount of their estimate -	69081		
Difference between the two estimates	20714 7		
The amount of my estimate - -			89795 7
	<u>£. 89795 7</u>		<u>£. 89795 7</u>

The great difference between the two estimates is accounted for in the various sums set down within 480 l. 7s.; but if the proposed canal, thus estimated by these engineers, was made of the same dimensions as that I have already proposed, it would cost at least 30,000 l. more than their Estimate.—It is worthy of remark, that building the locks is estimated at 65 l. 8 s. 4 d. per foot rise.—For the information of my readers, I will state what various locks have cost which have lately been

been built, and with which I am well acquainted. —The Ashton canal near Manchester, which is not quite finished, is a narrow one. The locks are made of brick, and the building of them was let for 75l. per foot rise; but this sum was found insufficient to make them as good as they ought to have been:—The locks on the Leeds and Liverpool canal near the summit are very good ones, and have cost about 120l. per foot: I speak this from good authority.—By the estimate Mr Jessop has made for the locks on the south line, I suppose he means them to be finished in the same manner as the aqueducts he designed for the Cranford canal in Derbyshire, part of which tumbled down in the year before the line was finished; and I think it not necessary to refresh his memory by informing him of the sum of money he proposed to allow out of his own pocket towards re-repairing them.—If he means to build locks for his estimate, the subscribers may expect they will share the same fate as the tunnel he designed on the grand junction canal in Gloucestershire, which last spring tumbled down to the amount of more than 20,000l.; after which Mr Whitworth was called upon to set out another upon entire fresh ground, but its fall was not owing to bad ground or bad materials.—Was I to mention the number-

less failures in canal works that have chiefly been owing to letting the work at an inferior price, I should astonish all that read the account.—If the gentlemen in the north wish their works to tumble down before the line is finished, I would recommend them to let the work by Messrs Jessop, Chapman, and Dodd's estimates for the south line; but if they wish their works to survive them, I would advise them to give such prices as will ensure good and substantial work; and not to let to any but persons of real property, for there is no security in letting to any other.—It is not a little extraordinary that these gentlemen should have omitted to take any notice of the most essential and constituent part of a canal, that is procuring water for its supply, yet not one word is said about it, nor one shilling allowed for it; but in my estimate I have allowed between 8 and 9,000 l. for procuring water. Their line is proposed to cross the Devil's Water by an aqueduct, consequently no water could be taken from that brook on the lower side the mill, and in summer months none could be taken from the upper side of it but by means of a reservoir, because there is not sufficient water in the brook to supply the corn mill in dry seasons, and last September there was scarcely water sufficient to work one of the wheels.

wheels. The line proposed by these engineers would cross the brook in Riding Burn upon a much higher level than to admit of taking water from the brook below the corn mill, and none could be taken into it in the summer months except by a reservoir, yet no mention is made of the expence of this or of purchasing the mill. It would also cross Stocksfield Burn upon a level that would not permit water to be taken from that brook but by a reservoir, for neither the corn mill above nor the fulling mill below would admit of it; and the place where it would cross Stanley Burn would not admit of any water being taken from that brook, on account of the corn mill, but by a reservoir, and this Mr Simpson's family would never permit.

As these gentlemen appear to be entirely at a loss to know how their line is to be supplied with water, I hope they will have the candour to excuse me for pointing out three different ways by which I think it may be supplied, and a fourth might have been found if the mills could have been purchased.—1st, Making sufficient reservoirs for the supply of the canal, which may be done without injuring the mills.—2dly, By pumping water from those places which may be judged most convenient.—3dly, I believe it possible to
supply

supply this line with water from the bason by erecting a weir somewhere not far from the foot of the north Tyne, and making a channel to conduct the water.—If the levels taken by Messrs Dodd and Chapman are accurate, no water can be taken to supply Mr Chapman's level at Hexham but by raising a weir of considerable height; but the very great breadth of the river and the adjacent lands forbid this, so that if the summit was to be supplied from the river it must be from the place before-mentioned.

The design of making surveys and estimates is to convey useful knowledge to the public when large works are undertaken; but whether these two engineers have made their estimates for either the south or north line in such a manner as to give that information to their employers and the public they had reason to expect, I leave the unprejudiced reader to judge.—The sum of 12,228l. set down for the remainder of the earth work, including the embankments and the cutting they have not specified, appears to me very extraordinary. If neither the height, breadth, nor depth of the embankments nor the deep cutting be specified, nor any price fixed per yard for the work, how or by what rule are the public or the subscribers to judge whether the estimate be a proper
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one or not?—Have these engineers informed the public what will be the depth and width of their proposed canal, or what quantity of tonnage they propose to navigate in one vessel? Not one word of this.

The bitter fruits of riding and cursory surveys are, that in most of the canals in this kingdom the subscribers have been put to the great inconvenience and expence of applying to Parliament for alterations and deviations, with fresh powers for borrowing nearly as much money upon the tolls as at first was calculated to finish the whole works; and many have been under the necessity of applying a third time; and there has not been one canal finished in Yorkshire or Lancashire that I know of which has not cost almost double the sum that was first calculated upon, and some much more, which I believe will hold good in a great measure throughout the whole kingdom. These evils will exist so long as subscribers suffer themselves to be misled by such surveys and estimates; and from whence do they arise but from the ignorance or inattention of engineers? For there certainly is no mystery in the principle or execution of a canal to justify the terrible deficiency that so frequently attends the estimates for them, though many engineers for canals would have mankind to believe that their business is nothing but mystery.

By

By the estimate I have made, the public will be informed what I think will be the expence of making a canal from Newcastle to Haydon-Bridge, on the north side of the Tyne; and it may be necessary to inform the subscribers to that scheme what quantity of tonnage per day will be required to pass on the line to pay them 5 per cent. interest, after wear and tear, wages, &c. are deducted.—I have supposed the capital sunk, when the line is finished, to be 183,450l. 15s. 6d. which does not include the large sums that must be expended in the preservation of those gentlemen's estates which will be so greatly injured by it, nor the expence of purchasing the way-leaves; and there ought to be two years interest added to the above capital, (because the canal can pay nothing until it be finished, as I have before explained) which, at the common rate, amounts to 18,345l. and added to the above sum, will make 201,795l. 15s. 6d.; and my opinion is, that if a good and useful canal is made, of the same dimensions I have given, and the work well executed, the last-mentioned sum will be sunk in principal and interest before a vessel of 50 tons burthen can be navigated between Newcastle and Haydon-Bridge. But I am no ways disposed to calculate upon the highest sum, and will reckon upon

upon the estimate without noticing the two years interest; and I will take the average of the tonnage at $1\frac{1}{2}$ d. per ton per mile (as I have done for the fourth line), and call the length 31 miles, and calculate upon 276 days in the year to navigate. If 232 tons per day navigate the whole length of the line, the amount will be 12,406l. 4s. from which one-fourth must be deducted for wear and tear and incidental expences, and the remainder will be 9,294l. 13s. being rather more than 5 per cent. interest on the supposed capital. Whoever will carefully and impartially examine the country through which this canal is proposed to pass, I think he must acknowledge that there is no prospect of even 50 tons per day being navigated on the upper part of the line, (that is, from 12 to 14 miles) which, to make up the average quantity of 232 tons, will require near 400 tons per day to be navigated on the lower part of the line—a tonnage, in my opinion, much more than double the quantity there is any probability of ever coming upon it. The engineer has said a great deal about the large quantity of lime that would be navigated upon the canal, (that there is an abundance of it near the line no one will deny) but I think there will be very little market for it; and from his stating the probable consumption to be so great, he appears to have examined the

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country

country rather superficially. In his Report he speaks of the great quantity of lime near the village of Wall; which I admit, but at the same time ask him where will he find a market for it? Not in the neighbourhood of Haydon-Bridge, for there are immense quantities of it, and of the best quality, at or near Allerwash; nor will that lime, or the lime from Wall, be carried on the canal to or near Hexham, because that neighbourhood can be cheaper served from Corbridge; nor will the Corbridge lime be carried on the canal upwards, because of the lime at Wall and Allerwash; and if this be the fact, it will not only be difficult, but impossible to find a market for any quantity of lime, to be carried from the upper part of the line, worth calculating upon; for it ought to be remembered that lime, coal, grain, or manure, is not worth putting aboard any canal vessel, if it is not to be carried six or eight miles at least; but committees that have great experience in conducting canals say, if not carried eight miles;—and, in my opinion, no lime to be got at Wall, Allerwash, or Corbridge, and carried on the canal six miles, or even five, can be delivered to the farmer (including his leading it from the canal) so cheap as he can have it from another place by land-carriage; and the lime from Wall will be attended with a considerable expence in getting it to the canal.

canal. Perhaps it may be said, that the Corbridge lime will be carried to the eastward; but this is not likely, as a great part of the adjacent country can be cheaper supplied from Stamfordham and Newcastle, and the neighbourhood, by lime brought up the river.

The engineer appears as much mistaken in his calculations on the supposed revenue from the tonnage of lime, as in that to arise from packet or pleasure boats. The revenue that may arise from the tonnage of lime must be very small, for two reasons; 1st, Because the Northumberland land does not in general require much lime, which I particularly examined into: The land on the south side of the Tyne stands most in need of it, and will be most effectually supplied by the south canal. 2dly, As nature has disposed of such immense quantities of lime rock in various places, and at almost equal distances, on and near the line, a water conveyance is, in my opinion, altogether unnecessary to supply Northumberland with lime, because the land-carriage will in general be cheaper than that by water.—Had nature disposed of the lime rock at only one end of the line, or at both ends; or if the ends had even been destitute of it, and it had been only found in the middle, then Mr Chapman's report on the supposed revenue to arise from it would have been entitled to

some degree of credit ; but as nature has placed it, it is impossible for much revenue to arise from it.

—Manure is represented as an article that will produce a considerable revenue ; but I think the principle on which the canal is proposed, occasioning a great extra expence in carrying it from the town of Newcastle to the basin, and afterwards unloading it into boats, will exclude it from coming upon the canal at all. The farmer may take it back in his empty carts cheaper than the canal can deliver it to him, considering the expence of unloading and carting it from the canal ; besides, manure is an article of no great pecuniary value, and consequently will not pay for a long water conveyance.—Coal is represented as another great source of tonnage, but I freely confess I cannot discover where it is to be carried from or to. The coal near Walbottle is from eleven to twelve miles from Corbridge, and from Hexham about sixteen miles, including one mile of land-carriage ; so that both those places are now served with coal from the south side, by land, cheaper than the north canal can supply them : Nor will the Walbottle coal go to Haydon-Bridge, for there is plenty in that part of the country.—There appears, then, but two markets that the canal can have any chance of supplying with coal, the first is the town of Newcastle, and the second is the export trade.

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The former of these the canal cannot supply, because the mines on both the east and west side of the town are so near, that the inhabitants may be supplied with coal by land-carriage cheaper than by the canal. It also appears that the canal can have but a very small part of the export trade, because the mines in general lie a great deal below the level of the canal, which will occasion great expence to carry the coals up; and a great part of them are within about two miles or little more from the town, and within less than half a mile from the river, and have good railways to communicate with it, so that there can be but a very small prospect of the coal from those mines ever coming upon the canal. I cannot see that any coal is likely to come upon it except Mr Blackett's; and how that gentleman has been persuaded to believe he can carry his coal as cheap by the canal as on his own railways, is surprising to me. —The pits from whence his coal is drawn are, I think, about one mile from the line of canal, and the mouth of them is about 170 feet, or perhaps something more, below the level of it; and when he has dragged them up this great ascent, he can only carry them about 7 miles by water, and then they must descend down the inclined plane in the same waggons in which they came from the pit, otherwise they will be so much broken as to be unfit

unfit for the market; but in order to do this, they will require to be placed on a kind of platform, (that is, a boat covered with planks.)—For every 30 tons of coal navigated on the canal this way there will be about 20 tons weight in waggons; and when the vessel should return empty, it will be nearly half freighted with empty waggons.—The extraordinary expence of making the great number of waggons that will be required, and the loss of time and inconvenience attending the leaving of the waggons and boats at the top of the inclined plane until the waggons can be sent down, will, I think, prevent Mr Blackett's coal from ever coming upon the canal.—I have been informed that Mr Blackett ships about 70,000 tons of coal per year, and if 276 days are allowed to navigate, this would be equal to $253\frac{1}{2}$ tons per day; and supposing a waggon takes two tons of coal at once, this would be equal to 126 waggon loads of coal per day which would have to descend the plane; and admitting 6 were to be sent down per hour (though I cannot think more than 5 can), it would require 21 hours per day to send down only the produce of one coal mine, and two sets of hands to work the plane, which would double the wages I have calculated upon for working it.

It is well known that all canals are frequently frozen up in winter, sometimes for a month or more,

more, and when the frost breaks up, large quantities of goods are required to be sent down in a short space of time; but this cannot be done by an inclined plane.—By what means does the engineer propose to correct this evil? Does he propose to multiply the inclined planes, and so make them equal to the discharge of this temporary surplus of tonnage? *—This he may do, it is true, and they may be multiplied until they are infinitely more expensive than locks. I think it is clear from this statement, that if there is only a small quantity of tonnage on the line, one inclined plane will not be equal to it, and two will be much more expensive than locks, as is shewn by the estimate for them.—In the year 1794 I was called upon to examine and make a report and estimate for the inclined planes in Coalbrook Dale, and explain what quantity could be sent down one of them in any given portion of time, for a number of mine-owners in Somersetshire, and having spent many days in examining those planes, I am enabled to know what time is required to send a given quantity of tonnage; and with locks properly placed and well constructed, I will engage to send down from the north canal to the river a greater

* If the inclined plane is only sufficient for one coal mine, what is to become of the lead, timber, iron, &c. and how is the thorough-fare trade of the country to be accommodated?

quantity of tonnage in twelve hours than the proposed inclined plane will send down in eight days, supposing it to work twelve hours in the day.—I have been the more particular in explaining these things, that the public may no longer be misled by the delusive idea of an inclined plane, for it never can answer for them or the subscribers, or become an adequate substitute for locks.

The engineer has calculated pretty largely upon the supposed tonnage to arise from grain, but in this I think he will be disappointed, as he has designed the canal in such a manner as to preclude a very considerable part of it from coming upon the line at all; nor will it ever be worth while for any farmer residing within ten or twelve miles of Newcastle to send his grain by the canal, because of the great expence and trouble that will attend unloading it at the basin and carting it into the town.

From the observations I have made and the reasons I have assigned, I think it is clear that the revenue expected to arise from the tonnage of lime and coal can be but very trifling, and that from manure and grain still less, by reason of the canal not locking down into the river. Three of these articles ought to have constituted the greatest part of the tonnage for the whole line, and the loss of them must prove fatal to almost any scheme of canal,

canal, nor can I conceive what substitute the engineer will find for them. It is true he has discovered several articles of tonnage rather singular in their nature, from which he expects a considerable revenue; but in a revenue to arise from the carriage of such articles as poultry, milk, butter, eggs, garden stuff, &c.* I have for my own part no great confidence or expectation; and though there is one article of tonnage that might be calculated upon with some degree of certainty, which is lead, yet from the engineer's account nothing great can be expected from it.

Having said thus much on the tonnage to be expected on the north canal, I shall briefly mention, that in my survey of that line I examined the country with great attention, to find out those great and numerous advantages the engineer speaks of respecting the easy communication of collateral branches with the canal in consequence of his high level; but that from one end of the line to the other I could not find any place where a branch could conveniently be made or furnished with water, nor could I discover on what occasion, or for what purpose, they ought to be made; and it appears to me that all these supposed conveniences will, on mature examination, be found

* See page 25, third part of Mr Chapman's Report, and p. 17, first Report.

to be the mere delusions of fancy. I will now proceed to make some observations on the estimate made by Messrs Jessop and Chapman and that made by me, and attached to this Report, of the expence of executing the north canal.

No doubt many of the subscribers to this line will be greatly surprized that my estimate should be more than half as much more than that made by Messrs Jessop and Chapman, but a few remarks on their survey and estimate will, I think, remove the surprize. These gentlemen, as I have before observed, have not informed the subscribers what kind of canal they are to expect, or of what dimensions it will be, and they are equally silent about the heavy expence which will attend the execution of many parts of it. From their report and estimate a stranger would conclude that difficulty and extraordinary expence were nowhere to be found on the line: On the contrary, the crossing of north Tyne by an aqueduct is one of the most formidable undertakings that has been attempted in this kingdom over any river where the tide does not flow. The height from the top of the battlement to the foundation will be near 80 feet, and the breadth of the river where it is proposed to be made is about 270 feet: The height of the embankment at one end I suppose will be about 50 feet; the length great; the deep cutting
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at the other end truly formidable, and the river perhaps the most rapid of any in the north of England. Astonishing that such a stupendous piece of work, which, according to my estimate, will cost upwards of 20,000l. should not be mentioned either in Mr Jessop's report or estimate! But perhaps he never saw it *. Mr Chapman, in his report, says, " The river runs over a bed of " rock confined by precipices on each side, which " of course afford an easy passage over the river, " although the bed of it lies 70 feet below the " level of the canal." From this description of passing the north Tyne, any person that has not seen it would conclude it was a simple, easy piece of work; for he says not one word about the breadth of the river, the length of the embankment, or the extra deep cutting, tho' the whole length of this, as near as I could judge, will be above 600 yards.—The engineer having described crossing the north Tyne as such an easy undertak-

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ing;

* Mr Jessop is no stranger to professional men making estimates and giving reports upon things they never saw; and perhaps he has not forgot that a popular engineer, in the beginning of the year 1794, surveyed the greatest part of a canal in a post-chaise, and made a fine report of the springs and feeders which would supply it with water; but in his examination before a committee of the House of Commons he was obliged to acknowledge that he had never alighted from his carriage, and had not seen many of the springs or feeders.

ing, I should be glad to have his description of what he would consider a difficult piece of work, and I should expect it would be something very extraordinary.—In the report of Mr Jessop he says not one word about the extra expence attending the making of four reservoirs; and he is equally silent about the great difficulty and heavy expences that will attend passing Caponcleugh burn, St Johnlee church, and many other places; nor do I think that report affords the subscribers much useful information in any respect.—The principal information Mr Jessop gives the subscribers is, that Mr Chapman had made his estimate on the most ample scale, and says, it appears that the average cost of execution will be about 3737l. per mile. In my opinion, Mr Jessop does not appear to have exercised his own judgment, but merely to echo that of Mr Chapman; for how was it possible for him to know how to average the expence of the canal per mile, unless he had carefully examined all the parts that are particularly expensive, as between Newcastle and Haydon-Bridge the extra work on the line will amount to more than 1500l. per mile, but no mention is made of this in any part of his report or estimate!

Is is the indispenfible duty of every engineer, when he is called into a country to survey a line
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of canal, carefully to examine that part through which it is proposed to pass, to see how far it is friendly to such a scheme, and what are the obstacles that militate against it; whether in procuring water for it, or in the execution of it; or whether a sufficient quantity of tonnage can be found in the country that will justify the undertaking; or whether the line will go through any particular estate or estates that may ultimately prove fatal to the scheme; or whatever difficulties may offer themselves to the consideration of the engineer when he is making his survey; and if either from negligence, self-interest, or for the purpose of serving any individual or a party, he wilfully holds from his employers any information that they need, he acts a part highly censurable and dishonest.—What are professional men called in for, but to give information?—*Why are engineers paid such high wages, but to induce them to take pains, and render service to their employers equivalent to the money they receive?* But surely this is not to be accomplished by surveying in a post-chaise, nor by making reports and estimates for things they have not seen, which can only be done by particular attention and unwearied application.—Whether Mr Jessop pursued this line of conduct when he made his survey on the north line, and whether the subscribers to that scheme received information from

from him equivalent to the money they paid him, they are the best judges.

It is probable that some of the subscribers to the north canal will think my estimate for the aqueduct over the north Tyne very high ; but if it is made a good substantial piece of work, I believe it will not be executed for less money than I have allowed, nor perhaps for that sum ; and to execute it upon a slender or bad principle, would be money laid out to no purpose : For if a misfortune was to happen, it would put an end to the revenue arising from the canal until the work was repaired, because the supply of water for the lower end of the line will have to pass over it ; and this shews the necessity of executing it upon the best principle.—The aqueduct that is now building at Lancaster has five arches, each 70 feet span, and from the surface of the river to that of the canal (I have been informed from good authority) was about 50 feet, and the piers are about 18 feet under water : Mr Rennie's estimate for that aqueduct was about 25,000*l.* as some of the subscribers have informed me.—Twelve months ago, the Committee informed the subscribers by a printed paper that they had paid upwards of 25,000*l.* on account of the aqueduct, and at that time I believe there was not one arch turned.—When the aqueduct and the embankments are finished, they will cost
near

near 40,000l.; and the earth-work for that aqueduct, I think, is not equal to that for the aqueduct over the north Tyne, and I have frequently examined the embankment at Lancaster.—Mr Rennie's estimate for crossing the river Ribble, near Preston, is about 60,000l.; but my opinion is, that double that sum will be required, if it is made as good and complete a piece of work as that at Lancaster; and this is the opinion of many able and experienced engineers.—I have made my estimate for crossing the north Tyne, to prevent the subscribers to that scheme, as far as I am able, from being plunged into the difficulty of having twice as much to pay for it as they expected. Considering the extraordinary height it will be, and the rapid river it will cross, it is not possible for such a piece of work to be too well executed.

The evils arising from cursory or negligent surveys are of greater magnitude than men are in general aware of, and their fatal consequences are best known where canals are most general. A person may subscribe a certain sum to a canal, which may be full as much as his circumstances will conveniently permit, little expecting that when he is putting out his arm full as far as he can reach, he may some day be called upon to advance as much more, or forfeit the sums he has already paid; yet numbers of persons and families have been distressed

treffed and nearly ruined from this cause. I am a
 real friend to canals, under proper restrictions and
 regulations; but must confess that much of their
 utility is lost by their being improperly conducted.
 —I shall subjoin a few general observations, which
 I hope may be of service to those who wish to be-
 come subscribers to a canal with no other view
 but the good of their families; such being the
 most liable to be imposed upon by false calcula-
 tions, and by which a person may form a tolerable
 judgment whether he ought to become a subscri-
 ber to a canal scheme or not.—A broad canal, of
 the dimensions I have mentioned for the south
 line, if it passes through a country in which the
 fall does not exceed from 10 to 12 feet per mile,
 may be considered of a moderate, easy fall, and
 the execution of it (including reservoirs and the
 expence of procuring water) may be estimated at
 about 5000l. per mile. If there should be a tun-
 nel on the line it will much increase the expence,
 as a wide tunnel for a 50 tons vessel should be
 estimated at from 17l. to 20l. per yard running
 measure.—The estimate for a narrow canal, with-
 out a tunnel, of the same rise as before stated, and
 from 31 to 32 feet top, with 5 feet water to navi-
 gate vessels from 20 to 22 tons burthen, may be
 taken at about 3550l. per mile, and a narrow
 tunnel at about 10l. 10s. per yard. If the whole
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of the tonnage be taken at 2d. per ton per mile, it will be rated rather too high; but whatever be the quantity of tonnage, one-fourth of the revenue must be deducted for wear and tear, clerks' salaries, and other incidental expences; and if the engineer who surveys the line and makes the estimate cannot make it appear, on rational principles, that there will be a sufficient revenue, after such deductions are made, to pay the subscribers 6 per cent. interest, no man who values his money, the prosperity of his family, or his peace of mind, ought ever to become a subscriber to such a scheme.

Having made these general remarks, I have now to observe, that I carefully examined the country through which the north canal is intended to pass, with a view to obtain information as to the quantity of tonnage which might reasonably be expected to come upon it, and it appears to me that there is neither probability nor possibility that it will ever pay the subscribers 3 per cent. interest; nor do I think it is in the power of any man to shew, upon reasonable grounds, that there is any prospect of it;—a consideration of the most alarming importance to those subscribers who support the scheme from no other motive than to receive a reasonable interest for their money; and the consequences will probably be very serious to those

who are deeply engaged in it.—Such, after the most mature consideration of the subject, and the best information I could obtain, is my deliberate conviction of the great inadequacy of the revenue to arise on the north canal; and whether the reports and estimates of Messrs Jessop and Chapman have been made with that judgment and precision as to warrant the subscribers to the scheme, in staking their money (and with that, perhaps their future prosperity) on those reports and estimates, I must leave to the determination of such subscribers.—Perhaps there are fathers who subscribe to this undertaking under the idea that by so doing they will lay the foundation of an increasing fortune for their children: Perhaps there are guardians and trustees for minors who subscribe on the supposition that they thus lay out to the best advantage the money of their wards, whose future prosperity may perhaps greatly depend upon it, and may eventually be much impeded by it. To persons in such situations, and indeed to the subscribers in general, my advice is, that they would seriously reflect on what I have said, and consider well before they allow themselves to be irrecoverably bound by an act of Parliament; and if, on mature deliberation, it appears that the scheme is not likely to be what they at first expected, they should regulate their conduct

duct accordingly; and I can assure them from the best authority, that they are at full liberty to withdraw their names in any stage of the bill, before it receives the Royal assent, on payment of their share of the expences incurred to that time; nor is it the Solicitor for the bill, but the two Houses of Parliament and the King, that can convert the subscribers into a body corporate.

After these observations, which appear most particularly applicable to the subscribers to the scheme of the north canal, I have now to notice other causes of objection to it, in which land-owners and residents near the line are more immediately interested, tho' the public at large are eventually so. The great number of public road bridges which will be necessary on the line, and particularly for a few miles east of north Tyne, will do the country irreparable injury, unless the commissioners of the turnpike-roads, and the persons whose business it is to look after the other public roads, do not take care to prevent the beds of the roads from being raised; for many of them are at present so very steep as to be scarcely passable with a carriage, and would actually become impassable by road bridges placed in the common way (several bridges being altogether inadmissible), which would raise the beds of the roads 8 or 9 feet higher. The parties concerned in these roads may, and it is

both their duty and their interest to have a clause introduced into the bill, to restrain the canal company from raising any road that already rises 3 inches in the yard *.—Another matter that requires the particular attention of the landed property, and more especially those gentlemen whose estates are immediately below the canal, is, that being on so high a level, if a failure should happen in its banks, and more particularly if it took place in the night time, the mansion-houses and estates below the level of the canal (of such description are the houses of Mr Hunter, Mr Fenwick, and Col. Bewicke) would be exposed to the most imminent danger, and might probably be totally ruined; and the adjacent lands in general would be deluged and laid waste. A breach in the canal bank, tho' at first only a few inches wide, would soon become a channel, through which a considerable part of the river Tyne would be conveyed to deluge the country; and the damage would in some degree be in proportion to the length of the summit level; for a pool of more than 30 miles in length, taking its whole supply of water from the river Tyne at its head, being let loose upon the country, would occasion a dreadful devastation of private property. To prevent as much as possible an injury of this kind, it will be necessary to have a clause in the bill to compel the canal company

pany to make a sufficient number of permanent stop-gates, with houses, and lock-keepers to keep them shut in the night. From inconveniences such as these the canal south of Tyne is remarkably exempt, its level not being above any mansion-house, and the locks being placed in different situations on the line, which will reduce the pools to a moderate length, nor will it take its supply of water from the Tyne.

I cannot conclude my observations on the two proposed lines of canal, without expressing my regret that the public mind has been thrown into such a state of uncertainty by the imprudent surveys which have been made, and the unmeaning reports and estimates which have been published; to which may be attributed all the expence that has been unnecessarily incurred, and all that prejudice and misunderstanding which has unhappily taken place; and at the same time I must regret that a line like that proposed on the south of the Tyne, abounding with a variety of articles only fit for water carriage to an extent almost beyond calculation, which affords a certain prospect of a profit to the subscribers that may one day be without a parallel, should have no better advocate than myself.

I think a canal from Newcastle to Hexham, or Haydon-Bridge, absolutely necessary, but it ought

to be laid out in such a manner as to make a proper part of a general communication between the two seas, which may at some future period be carried into execution ; and it appears to me, that no human ingenuity can find a line between Newcastle and Haydon-Bridge which can justify the subscribers in risking their money upon it, except on the south side of the river, whatever may have been asserted to the contrary : And of the line laid down on the north side, I repeat my decided opinion, that it cannot answer the purposes of the public for the various reasons I have assigned, or the expectations of the subscribers, because of the total insufficiency of its probable revenue to pay even common interest for the money requisite to execute it.

I am, GENTLEMEN,

Your obedient, humble servant,

JNO. SUTCLIFFE.

Halifax, 3d Jan. 1797.

ESTI-

E S T I M A T E.



Estimate for making a canal from Haydon-Bridge to Hexham on the south of the Tyne, 44 feet top, 24 feet bottom, and 6 feet water.

	£.	s.	d.
M AKING the bafon at Haydon-Bridge 300l. ; warehouse 1000l. - - -	1300	0	0
Making two public road bridges - - -	240	0	0
Making one culvert for Low Hall Burn - - -	65	10	0
Making a small wear to turn the Burn water into the canal 10l. ; cut and shuttle to conduct the water into the canal 12l. 18s. - .	22	18	0
Making a culvert over Crosley Burn - - -	86	12	0
Removing the present bridge over Crosley Burn to make room for the canal - - -	56	10	0
Diverting the turnpike-road for about 400 yards to make room for the canal - - -	296	15	0
Making a canal over Dean Burn near Wood-Hall mill - - - - -	75	10	0
Making a small piece of embankment over the said burn - - - - -	50	10	0
Making a small bridge over the said burn for the use of the canal - - - - -	18	10	0
A little extra cutting in the first field east of the burn - - - - -	35	0	0
Extra cutting west of the burn - - -	12	0	0
Extra cutting in the same field, length 180 yards, 8 feet to the water's surface, with 18 feet bottom, 32 feet top - - -	410	0	0
Lining puddle for the extra digging - - -	54	0	0
Carried forward	2723	15	0

	£.	s.	d.
Brought forward	2723	15	0
Cutting the canal from the east end of the burn at Haydon-Bridge to where the extra cutting begins at Wood-Hall meadow, length 1 mile and 220 yards	-	-	-
	1309	0	0
Lining puddle	-	-	-
	220	0	0
Fencing off the canal, making the bed for the towing path, graveling and refoiling the banks, at 1s. 6d. per yard running measure	-	-	-
	150	0	0
Making two occupation bridges (for not more will be wanted from Haydon-Bridge to the plantation that separates the Greenwich Hospital estate from Mr Armstrong's) at 66l. each	132	0	0
Making two regulating weirs and one temporary stop gate	-	-	-
	55	10	0
Making a wear on Crosley Burn to divert the water for the use of the canal 10l. 10s.; making the cut to conduct the water to the canal, with shuttle, &c. 16l. 10s.	-	-	-
	27	0	0
Cutting the canal from the east end of Wood-Hall meadow, where the extra cutting ends, to where the deep cutting begins in Mr Armstrong's estate, length 1740 yards	-	-	-
	1150	6	6
Lining puddle	-	-	-
	110	0	0
Making the bed for the towing path, graveling it, and refoiling the banks and fencing it off, at 1s. 6d. per yard	-	-	-
	130	10	0
Making two occupation bridges at 66l. each	132	0	0
Making a small embankment over the burn where the Greenwich Hospital estate joins upon that of Mr Armstrong's	-	-	-
	55	10	0
Making a culvert in the last-mentioned burn	-	-	-
	63	10	0
Deep digging in Mr Armstrong's estate, length 280 yards, depth to the water's surface 15 feet, 18 feet bottom, and 32 feet top, when lined	1344	0	0
Lining puddle	-	-	-
	84	0	0
Carried forward	7687	1	6

	£.	s.	d.
Brought forward	7687	1	6
Deep digging in Mr Tweddell's estate, first length 130 yards, average depth to the water's sur- face 9 feet	359	13	4
Lining puddle	39	0	0
Second length of deep digging in the said estate 240 yards, depth to the surface of the water 20 feet	1926	17	9
Lining puddle	72	0	0
First length of deep digging in Mr Milbank's estate 220 yards, average depth to the water's surface 28 feet	2743	9	6
Lining puddle	66	0	0
Second length of deep digging in the said estate 210 yards, depth to the surface of the water 18 feet 6 inches	1128	17	6
Lining puddle	63	0	0
Third length of extra cutting in the said estate 80 yards, average depth to the water's surface 3 feet 9 inches, (but this sum includes digging the whole depth of the canal)	120	10	11
Lining puddle	24	0	0
✎ The whole length of this deep digging is 1160 yards, average depth to the water's surface 16 feet.			
Making the bed for the towing path, graveling and fencing it off	87	0	0
Making two bridges, one at each end of the deep digging, for the towing horses to pass to the contrary side, at 60l. each	120	0	0
Cutting the canal from the end of the deep dig- ging in Mr Milbank's estate to Coastley Burn, length two miles	2512	4	0
Puddling the canal, and making it water tight this length	450	12	0
Carried forward	17400	6	6

	£.	s.	d.
Brought forward	17400	6	6
Making the bed for the towing path, graveling it, and refoiling the bank, fencing it off, &c.	285	0	0
Making two regulating wears	35	16	0
Building five occupation bridges, with grooves for stop gates, at 66l. each, and one road bridge	440	0	0
Extra expence in passing the wood in Mr Milbanke's estate on account of the ground being rocky, grubbing tree roots, &c.	264	10	0
Filling up a small valley in Mr Leadbitter's estate 63s. trunk 5l. 5s.	8	8	0
Extra cutting in the last-mentioned estate	25	10	0
A small embankment in the said estate at the end of the extra cutting	28	0	0
Another small embankment in the said estate at the plantation	15	0	0
Making a strong rough wall to support the foot of the bank in the steep ground in Coastley estate	256	10	0
Purchasing 52 acres of land at 70l. per acre	3640	0	0
Making an aqueduct bridge in Coastley Burn	335	10	0
Embankment over the valley, length across at the top 136 yards, the bottom 66 yards, the mean breadth being 101 yards, the height 57 feet	2534	19	3
Lining puddle	40	16	0
Extra cutting at the end of the embankment, length 140 yards	76	1	0
Making a small wear above the old corn mill (which is now a ruin), and a channel to conduct the brook into the canal	221	12	0
Cutting through a narrow neck of land west of Highwood House	32	12	0
Extra cutting in the field west of Highwood House,, length 80 yards, average depth to the water's surface 1 foot 9 inches	10	10	0
Carried forward	25651	0	9

	£.	s.	d.
Brought forward	256	51	0 9
Cutting through a narrow neck of land where the small wood is east of Highwood House	171	2	0
A small embankment in the same field	20	10	0
Cutting through a narrow neck of land on the east side the said field, and filling up a small valley	14	0	0
First length of extra cutting in Mr Wastell's estate 172 yards, average depth to the water's surface 6 feet	128	0	3
Second length of extra cutting in the said estate, length 50 yards, average depth to the water's surface 8 feet	59	12	4
Third length of extra cutting in the said estate 90 yards, average depth to the water's surface 11 feet	256	13	4
Fourth length of extra cutting in the said estate, average depth to the water's surface 5 feet	64	3	4
Allow for a little extra cutting in the said estate near the cottage house	35	0	0
Extra cutting at the top of the hill near the wind mill, length 250 yards, average depth to the water's edge 3 feet 6 inches	97	4	0
Embankment over the small rivulet and the pub- lic road, length 160 yards, average height 7 feet	148	5	1
Aqueduct bridge under the embankment for the public road	240	0	0
Culvert for the rivulet	56	10	0
Lining puddle for the embankment	48	5	0
Building a culvert over Cockshaw Burn, with side walls for the arch 14 feet high	264	15	0
Embankment over the valley and lining puddle	135	10	0
Extra cutting at the east end of the embankment, length 100 yards, average depth to the water's surface 7 feet	122	10	0
Carried forward	275	13	1 1

	£.	s.	d.
Brought forward	275	13	1
Making a culvert in Hencoats Burn	59	14	0
Making an arch for the road under the canal in the said burn	132	0	0
Embankment in the said burn	28	5	0
Building one public road bridge over the road leading to Wharnley, &c.	120	0	0
Ditto ditto leading to Mr Wastell's	120	0	0
Ditto ditto at the top of the hill near the wind mill	120	0	0
Ditto an aqueduct bridge over the public road south of the town 245l. 10s.; culvert by the side of it 45l.	290	10	0
Embankment and puddle for the last bridge	29	15	0
Building a public bridge near the bafon	120	0	0
Cutting the canal from Coaffley Burn to the bafon at Hexham, $2\frac{1}{2}$ miles	2935	6	8
Lining the canal with puddle where wanted	526	15	0
Making the bed for the towing path, graveling it, refoiling the bank, and making the fences	330	0	0
Building 12 occupation bridges, with grooves for the stop gates, at 66l. each	792	0	0
Making two regulating wears	37	5	0
Building seven locks, each about 9 feet 2 inches rise, making in all 64 feet rise, at 100l. per foot	6400	0	0
Digging the lock pits	256	10	0
Puddling the head and tail of the locks	70	5	0
Making moveable stop gates and frames, piling and puddling them	135	10	0
Purchasing 15 acres of land, at 86l. per acre	1290	0	0
Ditto 10 ditto ditto near the town, at 105l. per acre	1050	0	0
Carried forward	42356	16	9

	£.	s.	d.
Brought forward	42356	16	9
10l. per cent. for superficiais, utensils, temporary damages, and unforeseen expences	-	4235	13 6
Sum total for making the canal from Haydon-Bridge to Hexham	-	46592	10 3
Estimate for making the canal from Hexham to Stella, where the sum allowed for making the reservoir in Riding Burn is deducted	84770	0	1
Sum total for making the canal from Stella to Haydon-Bridge	-	131362	10 4
Estimate for making the canal from Stella to Newcastle, which would have been 1600l. more if I had not deducted from the estimate the expence of two of the proposed locks at Stella, which may serve for the lower end of the line at Newcastle	-	21523	2 9
6l. per cent. for surveys, engineers' attendances, obtaining the act, and carrying the works into execution	-	9173	12 2
Sum total for making the canal from Newcastle to Haydon Bridge	-	162059	4 6

N. B. Three thousand pounds or upwards may be saved in the deep and extra digging between Hexham and Haydon-Bridge, by taking a higher level of about 6 or 7 feet, and this will not in the least interfere with any private property.

ESTIMATE.

*Estimate for making a canal from Newcastle to Haydon-
Bridge on the north side of the Tyne, 44 feet top, 24 feet
bottom, 6 feet water.*

£. s. d.

BUILDING a warehouse and making wharfs, but near twice this sum will be required if any considerable quantity of business should be transacted on the canal, for as it will not lock down into the river, the warehouse will require to be a great deal larger (which will make it more expensive*) than it otherwise would have been, because the goods must be lodged in it until they can be carted away	-	4000	0	0
Purchasing four acres of land for wharfs, ware- house, and basin, all building ground, which I think is worth more than 500l. per acre		2000	0	0
Damage done to the public gardens by the canal passing through them	- - -	1000	0	0
Making a basin	- - -	500	0	0
Making a public road bridge near the basin		150	0	0
Cutting three miles of canal	- - -	3490	13	0
Puddling the canal and basin, and making them water tight	- - -	495	0	0
	Carried forward	11635	13	0

* The expence of making the warehouse and wharfs is next to nothing when compared with the Duke of Bridgewater's wharfs and warehouses in Manchester, which have cost him near 30,000l. and the price of the land is extremely low when compared with what other canal companies have paid.—There is one canal company pays for about 7 acres of land in Manchester upwards of 560l. per acre, for their wharfs, warehouses, and basin; and there is another canal company that pays for less than 5 acres of land in the same place upwards of 1160l. per acre, and the buildings upon it are worth very little, but the other plot of ground has none upon it.

	Brought forward	11635	13	0
Making the bed for the towing path, graveling it, refoiling the bank, and fencing it off, at 1s. 6d. per yard running measure		396	0	0
Filling up a small burn, and extra work to preserve Mr Hodgson's spring at his bath		22	5	0
Making a small embankment from near the top of the inclined plane to Miller's Hill		65	10	0
Making 1052 yards of double railway or inclined plane, with cast iron bars on oak sleepers, and proper channels to take off the water, at 17s. per yard running measure		894	4	0
Building a house for the Machinery to work in		86	12	0
Making the machinery, pullies, ropes, guiders, &c. &c.		264	5	0
Building a small steam engine for the ascending trade		645	0	0
Building a warehouse at the top and another at the bottom of the inclined plane, to contain the goods until they can be taken up or sent down the plane		520	0	0
Extra work on the side of the river in making room for the vessels, sinking the planes, or making a stage to land the goods on, and making conveniency for crossing the public road with the planes		378	16	0
Making a basin to contain the vessels, and a wharf for the coal waggons at the head of the plane		145	0	0
Building a house for the clerk that attends the plane		120	0	0
Purchasing one acre of land for the wharf, warehouses, planes, &c.		130	0	0
		3183	17	0
	Carried forward	15303	5	0

Brought forward 15303 5 0
 Expence of working the planes, two men for the top and two for the bottom, and one for the steam engine, at each 15s. per week; clerk 20s. per week; making in all 247l. per annum. —Wear and tear of the steam engine, fuel for it, wear and tear of machinery, ropes, &c. &c. 240l. per ann. making in all 487l. per ann. which is equal to sinking a capital in the works of 9040l.—But this I shall fully explain at the end of the estimate.

Making an aqueduct bridge over the new railway near Benwell	186 10 0
Purchasing 18 acres of land for the first two miles, at 130l. per acre	2340 0 0
Purchasing 9 acres of land for the third mile, at 100l. per acre	900 0 0
Cutting the canal the second three miles	3490 13 0
Puddling the canal, and making it water tight	495 0 0
Making the bed for the towing path, graveling it, refoiling the bank, and fencing it off, at 1s. 6d. per yard	396 0 0
Crossing East Denton Burn with culvert and embankment, including filling up a small valley near the Old Pit Hill, making a trunk, &c.	177 10 0
Filling up a small valley, and making a trunk near Walbottle	13 13 0
Purchasing five old houses and gardens in Walbottle, which the canal will destroy, at 50l. each	250 0 0
Filling up the second valley near Walbottle, and making a trunk	9 12 0
Purchasing 27 acres of land, at 90l. per acre	2430 0 0
Mason work, cast iron pipes, and brass valves for the banks of the three proposed reservoirs in Wal-	

Carried forward 25992 3 0

	£.	s.	d.
Brought forward	25992	3	0
bottle Dean, at 118l. 7s. 9d. each, (which is only one half of what I allowed for the same work for one of the reservoirs on the south side, because the banks being higher, and the reservoirs much more extensive, required the work to be both stronger and larger)	355	3	3
Making the three banks	822	10	0
Puddling them, and making them water tight	45	15	0
Diverting the public road, and making it upon the bank of the first reservoir, and making the bank stronger to support the road	65	10	0
Making a wear, shuttle, and chan- nel to convey the water on the side of all the reservoirs, and re- turning it into a brook below the third reservoir, which is more than a mile in length	125	10	0
Making a cut, and puddling it, to convey the water from the third reservoir into the canal	54	5	0
Purchasing about 20 acres of land, at 60l. per acre	1200	0	0
Ditto ditto ditto 18 ditto, at 15l. per acre	270	0	0
* Sum total for making the three reservoirs, with- out puddling the bottoms	2938	13	3
Making an aqueduct in Walbottle Dean	246	12	0
Carried forward	29177	8	3

* To prevent, as much as possible, these reservoirs from injuring the Duke of Northumberland's coal-mines, I think it will be necessary to puddle the bottoms of them, which, at 6d. per yard superficial measure, would cost 4598l. admitting them to cover 38 acres as supposed.

	£.	s.	d.
Brought forward	29177	8	3
Embankment and puddle	586	15	0
Cutting four miles of canal	4654	4	0
Puddling the canal, and making it water tight, at 175l per mile	700	0	0
Making the bed for the towing path, graveling it, refoiling the bank, and fencing it off . .	528	0	0
Purchasing 36 acres of land, at 90l. per acre	3240	0	0
Crossing the dean in Colonel Bewicke's estate with an aqueduct bridge 175l. 10s.; culvert by the side of or under the road, to take the water from it, 34l. 5s. . . .	1209	15	0
Embankment and puddle for the said dean . .	34	12	0
Diverting the coach road up the dean, and making a *culvert under it all the way to take off the water	386	10	0
Embankment and extra cutting in Coal-piece Dean	22	10	0
Making a culvert in Horsley Dean 66l. 5s.; embankments and puddle 95l. 15s. . . .	162	0	0
Grubbing tree roots in Horsley Wood	25	16	0
Cutting six miles of canal	6981	6	0
Puddling the canal, and making it water tight	1176	0	0
Making the bed for the towing path, graveling it, refoiling the bank, and fencing it off	792	0	0
Making an aqueduct bridge in Whittle Dean	340	0	0
Embankment and puddle (may cost much more, for I had not the exact depth)	1659	0	0
Deep digging for more than 500 yards on the south side; and the canal will be very difficult			
Carried forward	50675	16	3

* But in order that the canal may not render the estate quite unfit for a gentleman to occupy, the line will require diverting to more than three times the distance from the lodge it is now laid down, which would cause it to pass near 500 yards in about 50 feet extra cutting, which would cost more than 8000l.; for a tunnel would be necessary; nor should any canal pass so near such a house, gardens and pleasure grounds as those of Colonel Bewicke's but by a tunnel.

	£.	s.	d.
Brought forward	50675	16	3
to make there ; the expence great, but uncertain, owing to the extreme steepness of the ground, for the same length and depth of cutting in level ground would have had at least 11000 fewer yards to remove .	1986	12	0
Lining puddle	190	0	0
Extra damage that will be done to the houses and gardens at Ovington	130	0	0
Filling up a small valley near Ovington, and a small culvert	15	10	0
Filling up a small burn near the wood, and making a trunk	17	10	0
Filling up another small valley in the wood	12	5	0
Grubbing tree roots	38	10	0
Damage that will be done to the wood by the canal being executed	75	10	0
Mason work, cast iron pipes, and brass valves for the head of the reservoir in Whittle Dean (I have only charged these one-third of what I allowed for such work on the south line)	78	18	6
Making the head or bank of the reservoir, including puddling and making water tight	135	10	0
Making a wear, shuttle, and channel to convey the water by the side of the reservoir	18	5	0
Making a channel, and puddling it, to convey the water from the reservoir to the canal	147	10	0
Purchasing 10 acres of land, at 55l. per acre	550	0	0
	930	3	6
Carried forward	54071	16	9

	£.	s.	d.
Brought forward	54071	16	9
Cutting 6 miles and three-quarters of canal to the public road that leads down to Hexham brewery	7853	19	3
Puddling the above length, and making it water tight	1485	0	0
Making the bed for the towing path, graveling it, refoiling the bank, and fencing it off	891	0	0
Filling up a small valley opposite to Farnley Scar, and making a trunk	16	5	0
Extra expence in passing the wood opposite to Farnley Scar, (but it is probable it will be considerably more)	156	0	0
Embankment over a valley near the Scar	96	10	0
Making a short tunnel for about 180 yards, to avoid going over the top of the Scar *, at 18l. per yard	3240	0	0
Deep cutting at each end of the tunnel, and securing the banks	325	0	0
Embankment over a small valley east of Corbridge	74	10	0
Puddling the embankment	12	15	0
Extra cutting through the lime rock in Mr Thompson's estate at Corbridge	125	0	0
Making a culvert over Corbridge Burn	96	10	0
Embankment over the said Burn, length 186 yards	561	14	5
Lining puddle	85	16	0
Small embankment and culvert before the canal enters Mr Errington's estate	26	7	0
Carried forward	69118	3	5

* The strata is so uncommonly bad at the side, that I think it not practicable to carry the canal on the top or near the side of it, for I think the ground could not be kept open suppose deep cutting was to be adopted; but in order that the canal may be permanent, the line should be diverted, and not come within 60 yards of where it is laid down.

	£.	s.	d.
Brought forward	69118	3	5
Making a culvert to convey the water under the canal in Mr Errington's lawn or pleasure ground †		18	16 6
Extra cutting through the hill and the corner of the garden		12	15 0
Extra expence in cutting through the rock above the brewery		146	10 0
Lining puddle where the rock is		35	15 6
Purchasing 61 acres of land, at 8ol. per acre	4880	0	0
Building 27 public road bridges, at 12ol. each	3240	0	
Ditto 15 bridges for various private roads, including those that will be required for various waggon ways, at 8ol. each	1200	0	
Building 68 occupation bridges which will be about 3 each mile, at 65l. each	4420	0	
	8860	0	0
Making 10 regulating wears, at 15l. 15s. each; and 22 moveable stop-gates, with fill and sheeting pile (that is, planks made to fit the groove in the stone heads), at 14l. 14s. each	480	18	0
	83552	18	5
1ol. per cent. for superficial utensils and unforeseen expences	8355	5	9
Annual expence of the inclined planes, steam-engines, wear and tear of the machinery, servants'			
Carried forward	91908	4	2

† Should the canal pass through Mr Errington's lawn, and close to his gardens, as now laid down, that beautiful plot of ground, and every thing that renders that valuable estate and extensive mansion-house eligible for the residence of a gentleman, would be destroyed.—To preserve the estate from those grievous depredations it will be exposed to by the boatmen passing through it, and also to preserve its beauty and usefulness, would cost a much larger sum than I have calculated upon for the preservation of Col. Bewicke's estate.

	£.	s.	d.
Brought forward	91908	4	2
wages, &c. equal to a capital sunk in the works of	9040	0	0

Sum total for making the canal
from Newcastle to near Hex-
ham brewery, with the pro-
posed inclined plane

100,948 4 2

I have before observed, that the annual expence that would attend working the inclined planes would be equal to sinking a capital in the works of 9040l. and the expence of erecting them, as before stated, is 3,183l. 17s. making in all a capital of 12,223l. 17s.—If the annual expence should be what I have stated, (that is, 487l. per ann.) this will be equal to sinking the above capital, because this revenue will be annually to pay out of the revenue arising from the tolls, and at the year's end it will affect the subscribers just in the same manner as if the tolls had been mortgaged for 9040l. at 5l. per cent. interest, and on that account it must be considered as capital sunk; but when all the money has been expended that will attend making the inclined plane and the other works belonging to it, it will scarcely be equal to discharge the produce of one large coal-mine; and certain it is, that the number of hands before mentioned will be required to work the planes, if there is any quantity of business done by it that may justify the expence.—Notwithstanding the delusive plan of an inclined plane is proposed, I think the good sense of the committee will teach them to abandon the scheme, and lock down into the river near Newcastle, on the upper side of the bridge; for nothing can justify the introduction of an inclined plane but the absolute want of water, and to propose one as a substitute for locks on a broad canal when the river Tyne can be

Carried forward 100948 4 2

£. s. d.

Brought forward 100948 4 2

taken to supply it will be folly without a parallel; and therefore I shall deduct the whole expence that will attend the erecting and working the inclined plane, and calculate upon the canal being made with locks . 12223 17 0

88724 7 0

Should the canal lock down into the river any where near the town above the bridge, about 3500l. would be saved in building the warehouse, making wharfs, purchasing land, &c. which must be deducted -

3500 0 0

85224 7 2

The engineer has stated that there will be 205 feet rise by lockage at Newcastle, which at 100l. per foot rise is . 20500 0 0

Digging the lock pits . 677 13 0

Puddling the head and tail of the above locks . 185 0 0

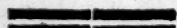
10l. per cent. for unforeseen expences . 2136 5 3

23498 18 3

Sum total for making the canal from Newcastle to near Hexham brewery with locks . 108723 5 5

Should the canal be made with the inclined plane, there would only be 7775l. 1s. 3d. saved, because the above two sums that have been deducted would then be to add.—If the line was to be extended as the engineer proposes, and pass through the town and lock down into the river at the quays, I am inclined to think it would cost more than double the sum I have allowed for locking down, owing to the uncommon difficulty of the ground, and the great injury that would be done to private property: But this is not the worst that would attend that plan; for by carrying the line in that direction, it would make it a mile and an half longer than locking down where I recommend, and would make the north line about three and an half miles longer

longer than that proposed on the south side of the river.—There is another heavy expence that will attend the north line, which I am inclined to think the principal part of the subscribers are unacquainted with, and that is, the indemnity the owners of way-leaves will require from the canal company; for there is no doubt but Parliament will take care that the present rents are guaranteed to the land-owners: It is a claim that cannot be resisted upon any principle whatever, as it is founded both on law and equity.—From the information I have received from some of the owners of way-leaves, there is reason to believe that there will be an indemnity required from 6 to 700l. per ann. which must be paid by the canal company if the owners carry their coal on the canal.—This is an entire new phænomenon in transacting canal business, that the subscribers should have to purchase the custom of the mine-owners at perhaps from 6 to 700l. per ann.—It frequently happens that the mine-owner has to be at a great expence in procuring the privilege of a water conveyance for his coal, but I think it was never known before that the subscribers to a canal had to pay for the custom of the mine-owner in such an extraordinary manner.—I would recommend it to every subscriber to know what he is to have in return for this surprising premium he is to pay, for I think it is an act of justice he owes to himself.



*Estimate for making a canal from the public road above the
brewery, near Hexham, to Haydon-Bridge.*

	£.	s.	d.
Cutting the canal to the north Tyne two miles and one quarter - - -	2617	19	9
Puddling the canal, and making it water tight	427	10	0
Making the bed for the towing path, graveling it, and refoiling the bank and fencing it off	290	0	0
Extra expence in digging the rock on the west side of the road leading to Hexham -	130	10	0
Lining puddle - - -	28	5	0
Carried forward	3494	4	9

	£.	s.	d.
Brought forward	3494	4	9
Making an aqueduct bridge over the walk in Mr Hunter's dean, 156l. 15s. and a channel by the side of the walk to take off the water, which will require covering over, 15l. 10s.	172	5	0
Making 200 yards of tunnel east of St John-Lee church, at 17l. per yard*	3400	0	0
Deep cutting at the two ends of the tunnel	278	10	0
Making an aqueduct bridge over the road to Acomb Corn Mill	179	15	0
Making a culvert for the brook	140	0	0
Making an embankment over the said burn	568	12	0
Lining puddle for the embankment	24	0	0
Making a culvert over Dear Burn	66	12	0
Making an embankment over the said burn	280	0	0
Lining puddle	54	6	0
Purchasing 20 acres of land, at 80l. per acre	1600	0	0
Cutting the canal 3 miles west of the north Tyne, to Allerwash Red-House	3490	11	0
Lining puddle, and making the canal water-tight	325	10	0
Making the bed for the towing path, refoiling the bank, covering the crown of it with gravel, and fencing it off	396	0	0
Deep cutting near Nether Warden to avoid injuring the Rector's house, gardens, &c. and getting clear of the steep ground in the plantation; the length of the cutting about 280			

Carried forward 14470 5 9

* There are two reasons why this tunnel should be made; the first is, the uncommon steepness of the ground under the church, which makes it next to impossible for a canal bank to be made to stand; and the second is, that if the present line was executed, it would destroy all the plantation and pleasure walks in Mr Hunter's estate, near the said church.

	£.	s.	d.
Brought forward	14470	5	9
yards; for without this deviation the house* will almost be rendered uselefs	-	1203	19 6
Lining puddle	-	84	0 0
Purchasing 27 acres of land at 65l. per acre	1755	0	0
Making back drains and three trunks	-	44	15 0
Cutting 3 miles of canal to the bason at Hay- don-Bridge	-	3490	11 0
Lining puddle, and making the canal water- tight	-	525	10 0
Making the bed for the towing path, graveling it, refoiling the bank, and fencing it off	-	274	10 0
Making an aqueduct bridge over Allerwash Brook	-	366	12 0
Making a road arch under the canal for the use of the mill	-	168	5 0
Making the embankment about 180 yards, (I think this will cost more money)	-	388	15 0
Lining puddle	-	54	5 0
Extra expence in cutting through about 450 yards in length of lime rock	-	146	12 0
Lining puddle	-	135	2 6
Making a small culvert before the canal enters the wood, and filling up the burn	-	19	1 0
Making a small culvert in the wood	-	32	10 6
Making a large culvert in the wood, with in- verted arch, and wing walls	-	95	15 0
Making a strong breast wall of acholer in Capon- cleugh, from the bed of the river to support	-		
Carried forward	23255	9	3

* In order that the canal may be made durable, and the Reclor's house, gardens, &c. may not be injured, I think it will be necessary to divert the canal at that place, to avoid the steep ground above the said house in and near the plantation, for there it is so exceeding steep, that it will be very difficult to make the bank stand; but if it could be done, I am of opinion, in the end it would be as expensive as the deep cutting.

	£.	s.	d.
Brought forward	23255	9	3
the canal bank and breast, and benched work above to prevent the hill* from sliding down, the length about 420 yards	3500	0	0
Making breast work, and wiewing along the river side for about 400 yards below the bason, to prevent the floods from destroying the canal	450	15	0
Making a culvert for the burn near the bason	58	12	0
Extra cutting below the bason	356	0	0
Making the bason and puddling it	300	0	0
Cutting a channel from the bason, and arching it over, to take in the water at the end of the bridge	240	10	0
Making a clow and rack wall to draw it at the mouth of the channel	25	15	0
Building a warehouse and making a wharf	1000	0	0
Building a wier,† say two feet high on the up- per side of the bridge to supply the canal with water	650	0	0
Purchasing 27 acres of land, at 60l. per acre	1620	0	0
Carried forward	31457	1	3

* I am of opinion it is not practicable to make a canal through the wood in Caponcleugh as the line is laid down; the steepness of the ground both above and below it, are obstacles that I think cannot be got over with open cutting, add to this that the line is close to the river; these difficulties I think render a tunnel absolutely necessary. — 420 yards at 20l. per yard

£. 8400
Deep cutting at each end 825

£. 9225

It is the worst place I ever saw for open cutting.

† This wier, in my opinion, will greatly endanger the foundation of the bridge, and may cause it to be blown up. The most proper place to erect it is about 400 yards up the river, and then no harm could be done to the bridge by it.

	£.	s.	d.
Brought forward	31457	1	3
Building 11 public road bridges, at 120l. each	1320	0	0
Ditto 26 occupation bridges, at 65l. each	1690	0	0
Making five regulating wiers, at 15l. 15s. each	78	15	0
Making eight moveable stop gates	-	118	11 0
Making three back drains and trunks	-	125	10 0
	34789	17	3

Estimate for making an aqueduct bridge over the North Tyne.

£. s. d.

As the river runs over the rock where the aqueduct is proposed to be made, getting a good foundation will be attended with little expence, in turning off the water and cutting the rock to admit of the piers and the abutments

375 0 0

Length of a pier 56 feet, breadth at the bottom 15 feet, and should diminish gradually to 13 feet breadth at the top. The pier should be continued 56 feet in length, until it rises 12 feet, this supposes three feet of it sunk in water when the river is at a moderate height; and then it should be reduced to 46 feet, and gradually diminish to 44 at the top, and the height to the springer will be 34 feet from the foundation, and will contain 23341 cubic feet

The two abutments, if properly made, will contain full as many cubic feet as the three piers, but I will call them the same; the sum total of the whole will be 140046 cubic feet, at 1s. each

7002 6 0

Carried forward 7377 6 0

Brought forward

£.	s.	d.
7377	6	0

When the pier gets 17 feet high, there ought to be a course of throughs all round it 6 feet long, and there should be a groove cut in this course to admit of an iron gad or plate three inches broad, and three-quarters of an inch thick, with a cramp or foot on the under side of it every six feet, which should be let into the stones six inches deep, and then this gad will act like a hoop upon the pier; and at the top of it before the springer comes on, there should be another gad or plate like that in the middle. All the acholer stones for the piers and the abutments should be from two feet nine inches, to three feet six inches on the bed, and from four feet six inches long, to five feet six inches; and there should not be less than 12 throughs in every course round the pier; none under five feet six inches long, and the face of all the acholer should be well dressed with the chissel.

I propose four semicircular arches, each 60 feet span, and all the stones at and near the springer should be three feet on the bed, and gradually decrease to two feet at the crown. One of these arches will be about 100 feet in circumference, measured from the middle of the key stone, and 44 feet in breadth, will contain 11,000 cubic feet; this multiplied by four, the number of arches, the product will be 44,000 cubic feet, at 1s. 6d. each

3300	0	0
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There should be a groove cut in a course of stone on each side the arch, about the middle way from the springer, to admit of two gads, the same as those for the piers, and these will prevent the arches from giving way or separating; and the key stones ought to be cramped together for about 9 feet at each end of the arch.— All the backings for the piers and the abutments should be flat on the bed, the same thickness as

Carried forward

10677	6	0
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$\begin{array}{r} \text{£.} \quad \text{s.} \quad \text{d.} \\ 10677 \quad 6 \quad 0 \end{array}$

Brought forward

the acholer, squared with the hammer, that they may joint close together; the length from two to three feet, and the breadth as large as can conveniently be got; and the backing and acholer should be exactly even at every course.

Backing for one arch, average breadth 22 feet, depth 33 feet, length 39, will contain 28314 cubic feet; this multiplied by 5 for the three arches and the two abutments, the product will be 141570 cubic feet, at 6d. per foot (but this is rather too low) - - 3539 5 0

Acholer to wall between the arches and the abutments to raise them to the crown for both sides the aqueduct, which should be full one-fourth part throughs 5 feet long, to tie unto the rough wall that will be on the back side of them, average width 22 feet 6 inches, depth 33 feet, thickness 2 feet 6 inches, will contain 1856 feet 3 inches; this multiplied by 10 for both sides the aqueduct (but the abutments will contain more than I have calculated upon), the product will be 18562,6 cubic feet, at 1s. 3d. per foot - - 1160 3 0

Height of the acholer wall from the crown of the arch to one foot above the surface of the water 10 feet 6 inches; that is, 3 feet 3 inches for the puddle and the flags, 6 feet for the depth of water, and 1 foot above it.—The thickness of this wall 2 feet 6 inches; one-fourth part of it throughs the same as before; the length of this wall for both sides the aqueduct 700 feet, will contain 18375 cubic feet, at 1s. 3d. per foot - - 1148 8 9

Acholer for both battlements, length 700 feet, height 4 feet 6 inches, thickness 2 feet, will contain 6,300 cubic feet, at 1s. 3d. per foot 393 15 0

100 roods of rough walling, 3 feet thick on the back side; the acholer 1 foot higher than the

Carried forward 16918 17 9

	£.	s.	d.
Brought forward	169	18	17 9
surface of the water, with stones from 12 to 14 inches on the bed, and from 6 to 8 inches thick ; the edges well scrapped with the hammer, and well flushed with water mortar, at 63s. per rood - - -	315	0	0
100 roods more of the same wall, to keep up the side puddle, at 63s per rood -	315	0	0
Raising 10 pilasters to support the walls and the abutments, at 90l. each - -	900	0	0
Puddling the sides of the aqueduct, 800 yards, at 9d. per yard - - -	30	0	0
Ditto the bottom of ditto, 1016 yards, at 9d. per yard - - -	38	2	0
Flagging over the puddle - - -	114	0	0
Making a foot-path by the side of the battlement ; 160 yards of strong flags, 3s. per yard running measure, 4 feet broad -	24	0	0
Covering the towing-path with a coat of good stone and gravel - - -	13	10	0
Making a moveable stop-gate at each end of the aqueduct - - -	27	10	0
Making the centers, finding scaffolding, ropes, blocks, cranes, &c. both for the quarries and the aqueduct ; paying damages for the stone-getting, repairing the roads, &c. -	950	0	0
Expence of iron and lead work for the piers, arches, and cramping the corners of the piers, ten feet high - - -	372	16	0
Embankment at the west end of the aqueduct, deep digging at the east side ; extra digging at both ends of it, to set the abutments back into the hill to prevent the river being too much contracted by the piers ; puddling the embankment and the deep digging -	3560	0	0
Carried forward *	23578	15	9

* The price allowed for the mason work includes getting, leading, and fitting, as well as all lime, sand, and cement.

	£.	s.	d.
Brought forward	23578	15	9
Making the canal from near Hexham brewery to Haydon-Bridge	34789	17	3
	58,368	13	0
10l. per cent. for superficial utensils and unforeseen expences	5836	17	3
Sum total for making the canal from near Hexham brewery to Haydon Bridge, including the aqueduct	64205	10	3
Sum total for making the canal from Newcastle to near Hexham brewery, with locks	108723	5	5
6l. per cent. for surveyors, engineers, obtaining the act, and carrying it into execution, including every expence	10521	19	10
Sum total for making the canal on the south side of the Tyne, from Newcastle to Haydon-Bridge, including 6l. per cent. for obtaining the act, &c. &c.	162059	4	6
Balance in favour of the south line	21391	11	0
	183450	15	6
	183450	15	6

From the above statement it appears that a canal may be made on the south side of the Tyne, between the two before-mentioned places, for near 22,000l. less than on the north side, and will be between two and three miles shorter; and the subscribers to the south line will have greatly the advantage over those of the north canal, because the one will be greatly burthened with rents for way leaves if the coal from certain mines come upon the canal, whilst the other will have nothing to pay.

